

SURFACE WATER STATION DESCRIPTION

RINCON CREEK NEAR MADRONA RANGER STATION – 320745110365701

SAGUARO NATIONAL PARK

Updated by: Gwen Gerber Date: 12/2/2005

LOCATION

The National Park Service's Water Resource Division – Water Rights Branch (NPS-WRB) surface water gaging station (Station) on Rincon Creek within Saguaro National Park (SAGU) is located at Latitude 32°07'45", Longitude 110°36'57" (NAD83) just east of Tucson in Pima County, Arizona (NE ¼ SW ¼ NW ¼ Section 16, T15S, R17E). The Station is located at Pool A, the upstream-most of three pools (A, B, and C) located along along the middle reach of Rincon Creek on the southern boundary of the eastern district of Saguaro National Park (hydrologic unit code 1505032). The middle reach of Rincon Creek stretches from the confluence of Rincon and Chiminea creeks to a point about one-half mile downstream. A staff gage at Pool B is located approximately 0.2 miles downstream of Pool A and a staff gage at Pool C is located 300 feet downstream of Pool B. USGS gage 09485000 (Rincon Creek Near Tucson, AZ) is located downstream of the Station approximately 0.6 miles from the NPS Station (**Figure 1**).

Contact SAGU park personnel Don Swann at (520)-733-5177 prior to accessing the Station. Don will notify the gate house. To access the Station from SAGU park headquarters drive southeast on Old Spanish Trail approximately 8.7 miles. Turn left (northeast) on the X-9 Ranch Road. Drive approximately 3.8 miles on the gravel road to the gate house. Identify yourself as NPS personnel and continue on the road. After approximately 1000 feet, take the first left (northwest). Follow the road straight towards Rincon Creek. As the road veers west park in the large pull-out. Walk upstream (east) approximately ¼ miles to the Station.

ESTABLISHMENT

The Rincon Creek Station was installed on June 10 and 11, 2003. The Station began recording at 15 minute intervals starting on June 11, 2003. The Station was established to support instream flow claims for Rincon Creek.

ELEVATION

The elevation of the station is approximately 3,160 feet above the National Geodetic Vertical Datum of 1929 as determined from the Tanque Verde Peak USGS 7.5 minute topographic map.

HYDROLOGIC CONDITIONS / DRAINAGE AREA

Rincon Creek lies within the Santa Cruz River basin and drains the Rincon Mountains of SAGU and Coronado National Forest. Drainage area is 39 square miles (based on EPA software: Basins 3.1). Rincon Creek is classified as an intermittent stream. Streamflow in Rincon Creek generally occurs during two "wet" seasons: 1) late winter / early spring characterized by sustained flows; and 2) late summer / early fall or the monsoon season characterized by brief periods of flow. The climate in the Tucson area is classified as subtropical desert with an average of 12 inches of precipitation per year (<http://www.friendsofsaguaro.org/climate.html>).

Due to the variability in precipitation events in the subtropical desert environment of Rincon Creek two weather stations are used to relate precipitation events with the Station's flow events. The Vail 7N weather station is located within the Rincon Creek drainage basin at an elevation of 2980 feet and 6.4 miles west (downstream) of the Station. The data from the Vail 7N weather station is purchased on-line from the *National Climate Data Center* (<http://www.ncdc.noaa.gov/oa/ncdc.html>). The Rincon RAW's Station is located at an elevation of 8240 feet and is located within the Rincon Creek drainage basin in the Rincon Mountains, approximately 6.5 miles north of the Station. The Rincon RAW's Station data is downloaded from the following web-site: <http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?azARIN>. See **Figure 2** for a Weather Station Location map.

Vegetation, from the dry saguaro forest above 2,000 feet to cool moist coniferous forests of Mica Mountain at 8,666 feet, includes seven distinct biotic communities: desert scrub, desert grassland, chaparral, oak woodland, pine-oak woodland, pine forest, and mixed conifer forest (<http://www.friendsofsaguaro.org/biotic.html>). The geology of the lower Rincon Creek basin consists of a thin veneer of alluvium on top of the Pantano Formation (cemented conglomerate). Higher elevations in the drainage basin consist of metamorphic rocks from a 3-humped core complex (<http://www.friendsofsaguaro.org/geology.html>). The majority of the Rincon Creek drainage basin consists of national park lands with a few residential and grazing properties.

CHANNEL AND CONTROL

Channel geometry at the Station appears stable. The channel bottom is composed of silt and sand with medium to large embedded cobbles and small boulders. Banks are stable and covered with woody vegetation, rootwads, and some exposed boulders. The control at low to mid-flows is a riffle approximately 40 feet downstream of the Station's staff gages. The control appears stable and is composed of embedded cobbles and boulders (**Figure 3**). The control at higher flows is the channel. The channel is underlain by the Pantano Formation which is found exposed just 100 feet downstream of the Station (**Figure 4**). Lenses of sand move through the system during high flow events and are evident in the Station's gage pool as seen by comparing photographs from February 2004 and August 2004 (**Figures 5 and 6**). The channel is straight for 30 feet upstream and 100 feet downstream. Bankfull is at an approximate gage height of 3 feet (**Chart 1**). A secondary channel on the left bank conveys flow during high flow events. Floodplains are composed of moderately heavy riparian vegetation typical of subtropical desert environments.

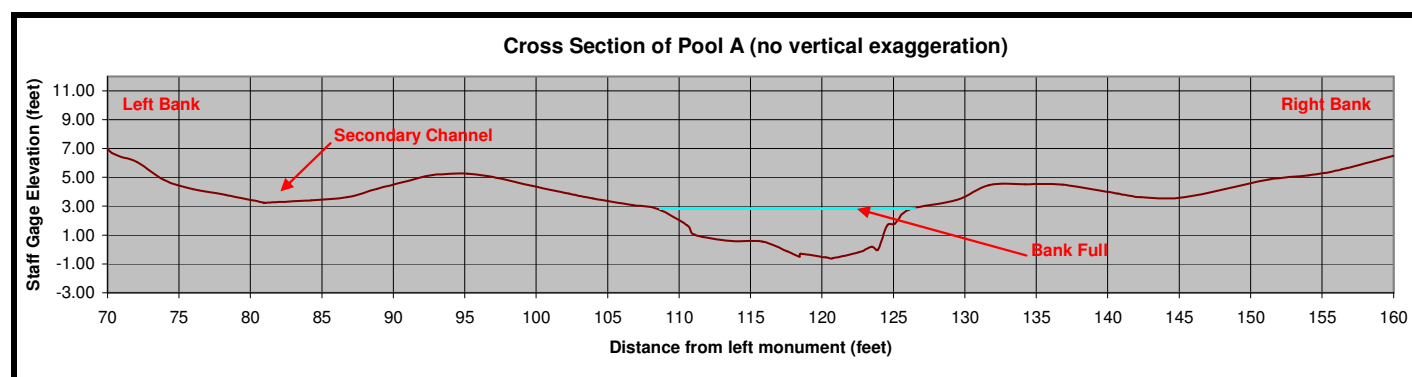


Chart 1: Cross Section of Gage Pool (constructed from data from NPS Consultant Mark Briggs)

GAGE

The stage sensor is a Design Analysis (Water Log® Series Model H-350XL logger and H-355 bubbler). This unit is the data collection platform (DCP), but may also be referred to as the 'logger' or 'datalogger'. The DCP is housed in a Hoffman steel enclosure mounted to 4 x 4 inch wood posts (**Figure 7**). The datalogger is programmed to purge every two days to displace sediment and keep the orifice clear. Gage height data are logged at 15 minute intervals.

The orifice line is encased in 1½ inch galvanized steel pipe (**Figure 8**). The pipe is anchored with concrete and rocks buried into the stream bank and is also attached to a concrete anchor on the stream bed. The orifice line is encased in 1 inch PVC from the steel enclosure housing to the galvanized pipe. The orifice was installed about 0.15 foot above the stream bed. The base gage is an enameled outside vertical staff (OVS) in two sections reading from 0.00 to 6.74 feet, mounted on treated 2 x 6 inch wood boards (**Figure 9**). A crest stage gage (CSG) composed of a 4 foot long piece of 2 inch galvanized pipe was installed on two 4 x 4 inch wood posts in May of 2005 to confirm peak flows (photo pending).

The NPS-WRB has a cooperative agreement with the Cheyenne, WY district of the USGS to use their database for processing stream flow records (Automated Data Processing System, ADAPS, version 4.4). Streamflow records for the Rincon Creek Station are processed on a water year basis under the ADAPS station name and number: Rincon Creek Near Madrona Ranger Station, AZ #320745110365701.

HISTORY

The USGS has been measuring stream discharge within the middle reach of Rincon Creek, approximately 0.6 miles downstream of the NPS gage, since 1952. During the years 1975 to 1984 only the annual maximum peak streamflow was collected.

The NPS Station has remained at the original location since its establishment in June, 2003. The following is a chronological log of the Station history.

June 10 and 11, 2003	NPS Station installed
June 25, 2004	Three reference marks ¹ (RM's) installed
May 24, 2005	Crest stage gage installed

REFERENCE AND BENCHMARKS

A base² (the ground rod), three reference marks (RM-1, RM-2, and RM-3), and three measuring points (bolts on the OVS's and CSG) have been established at the Station for elevation control. See **Table 1** for elevations. See **Figure 10** for a sketch map and a description of each survey point.

Date	Ground rod (base)	RM-1	RM-2	RM-3	OVS 1 (bolt on lower staff plate)	OVS 2 (bolt on upper staff plate)	CSG	Remarks
06/11/03	9.33				3.08	5.51		
06/25/04	9.33	6.61	4.95	5.62	3.08	5.51		RM-1, RM-2, and RM-3 established on this day
5/24/05	9.33	6.62	4.96	5.63	3.09	5.51	4.95	CSG installed on this day

Table 1: Base, reference, and measuring point elevations.

DISCHARGE MEASUREMENTS

Wading discharge measurements at low and mid-flows (less than 100 cfs) are taken at a cross-section approximately 20 feet downstream of the Station's staff gages. Very low flow discharge measurements (less than 5 cfs) are taken further downstream (approximately 200 feet) where bedrock is exposed and constricts the channel (**Figure 9**). These wadeable cross-sections are generally good with uniformly distributed flow, a generally smooth channel bottom (with few cobbles/boulders), and stable banks. Discharge measurements over 100 cfs need to be determined via indirect methods because of the inability to wade at these flows.

FLOODS

According to the 51 years of record of the downstream USGS gage the average annual peak flow is about 1800 cfs. Flows exceed 5,000 cfs about once every 10 years. Flows have not exceeded 10,000 cfs during the 51 years of record. The highest peak flow (9,660 cfs) on record occurred during a monsoon event on August 19, 1971. The lowest peak flow (23 cfs) on record occurred on March 22, 2003.

POINT OF ZERO FLOW

The point of zero flow (PZF) is the deepest part of the channel at the control approximately 40 feet downstream of the gage pool. Since the control appears to be quite stable, it is believed the PZF should not vary significantly from year to year. The "gage height scale offset" was determined to be 1.70 feet by the Johnson's Equation (Kennedy, 1983). This number

¹ A reference mark is a permanent marker installed in the vicinity of the gage. Its elevation above the gage datum is determined via levels survey.

² The base is the reference mark on which all reference mark elevations are based (it is considered the most stable).

usually approximates the PZF (Kennedy, 1983). The elevation of the PZF was also surveyed on two occasions (1.41 feet on 6/25/04 and 1.65 feet on 5/24/05). The survey in May, 2005 is considered more accurate because there was still minimal flow in the creek during the time of the survey (i.e., it's easiest to locate the PZF during low flow periods). During the site visit on 6/1/05 the creek was just barely flowing at a gage height of 1.61 feet. In conclusion, based on the calculation from the Johnson's Equation (1.70 feet), the 5/24/05 survey (1.65 feet), and the 6/1/05 gage height observation (1.61 feet), it is believed that the PZF occurs between 1.6 and 1.7 feet. During water year 2006 a cross section at the control will be surveyed which may further define the PZF.

WINTER FLOW

No ice effect has been noted on Rincon Creek. Winter temperatures rarely drop below the freezing point with average daily winter temperatures in the low 50's.

REGULATION AND DIVERSION

No known dams, stockponds, or diversions are located upstream of the Station. Several domestic water wells and at least one public water supply wells are located within the Rincon Creek drainage basin, it is unknown if these wells influence surface water levels.

ACCURACY

During low and mid-flows (less than 100 cfs) accuracy of the Station equipment and data is good. During high flows (> 100 cfs) accuracy of the Station data decreases to fair due to the inability to collect direct discharge measurements.

LOCAL PARK PARTNER

The following personnel from SAGU performs discharge measurements, downloads the data logger, and obtains regular staff plate readings:

Chuck Perger (Park Volunteer) (520)-885-7401 (home)
Matt Daniels (520)-733-5175
Colleen Filippone (520)-546-1607 3#
Don Swann (520)-733-5177

Saguaro National Park
3693 South Old Spanish Trail
Tucson, AZ 85730-5601

REFERENCES

Kennedy, E. J., 1983. Discharge Ratings at Gaging Stations: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A10. 59 p



Rincon Creek Gage Location Map

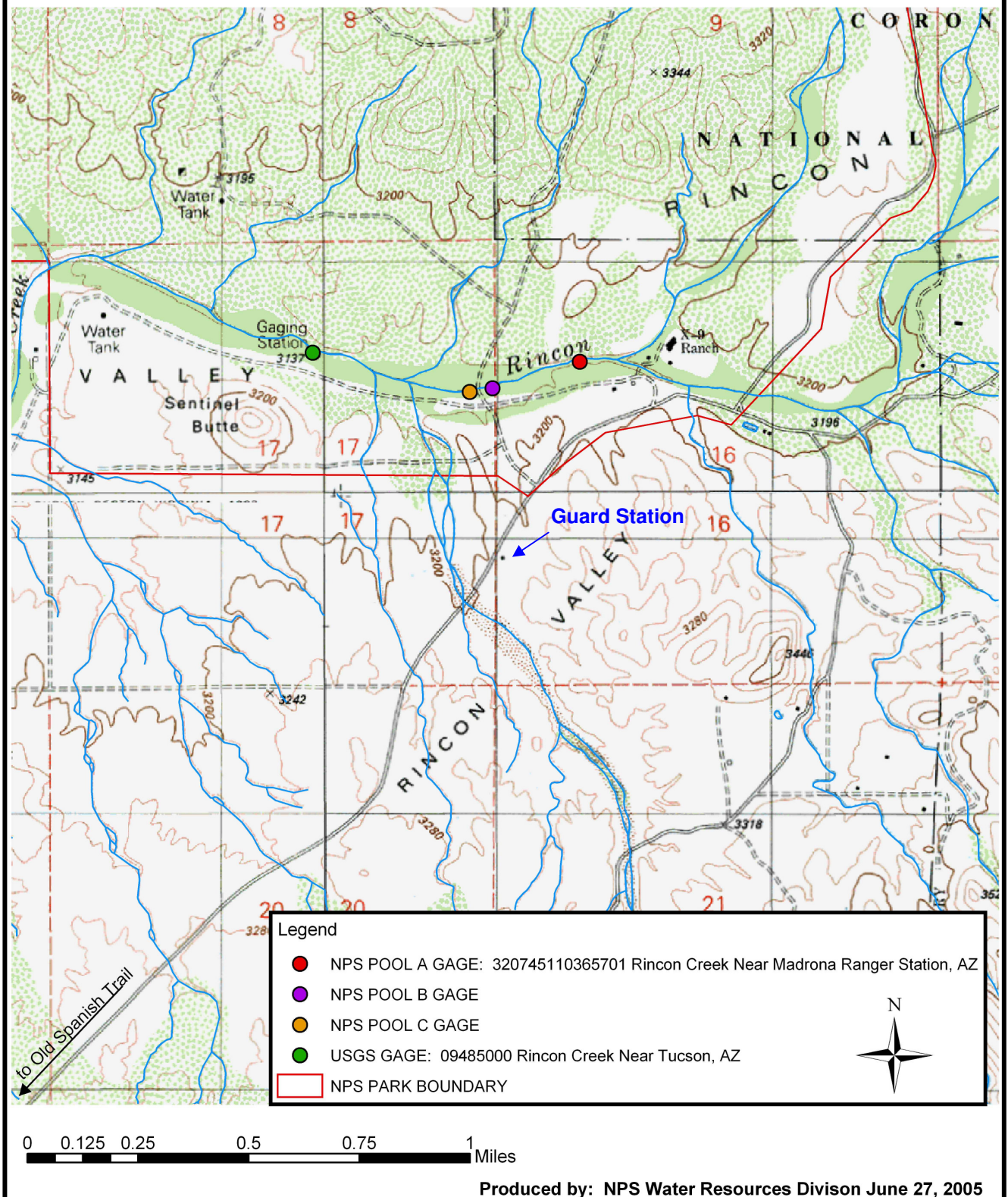


Figure 1: Station Location Map



Weather Station Location Map

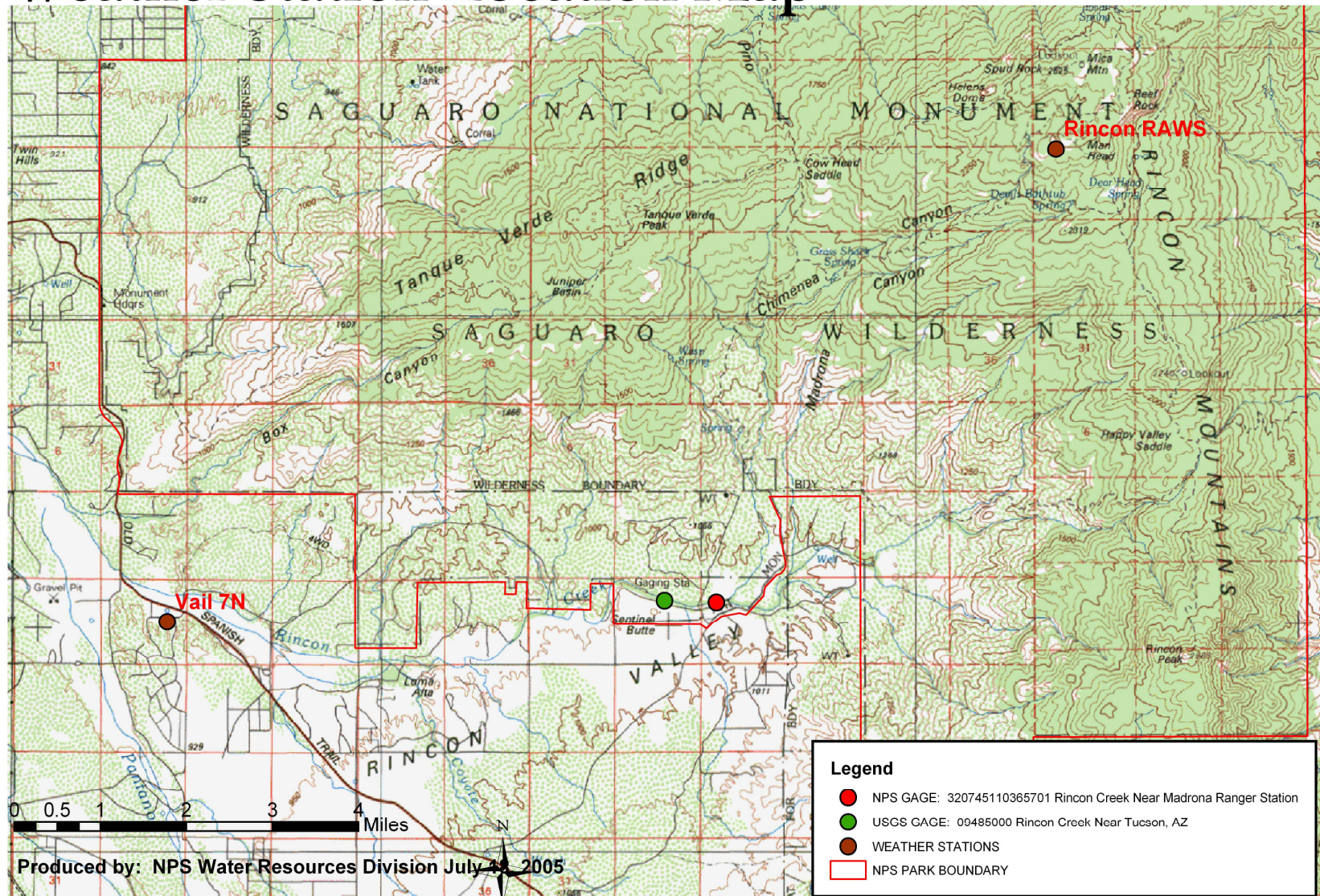


Figure 2: Weather Station Location Map



Figure 3: Photo of Station's gage pool looking downstream at control (photo taken 5/1/03 by Paul Christensen)



Figure 4: Photo of the Pantano Formation and low flow measuring point downstream of Station (photo taken 5/1/03 by Paul Christensen)

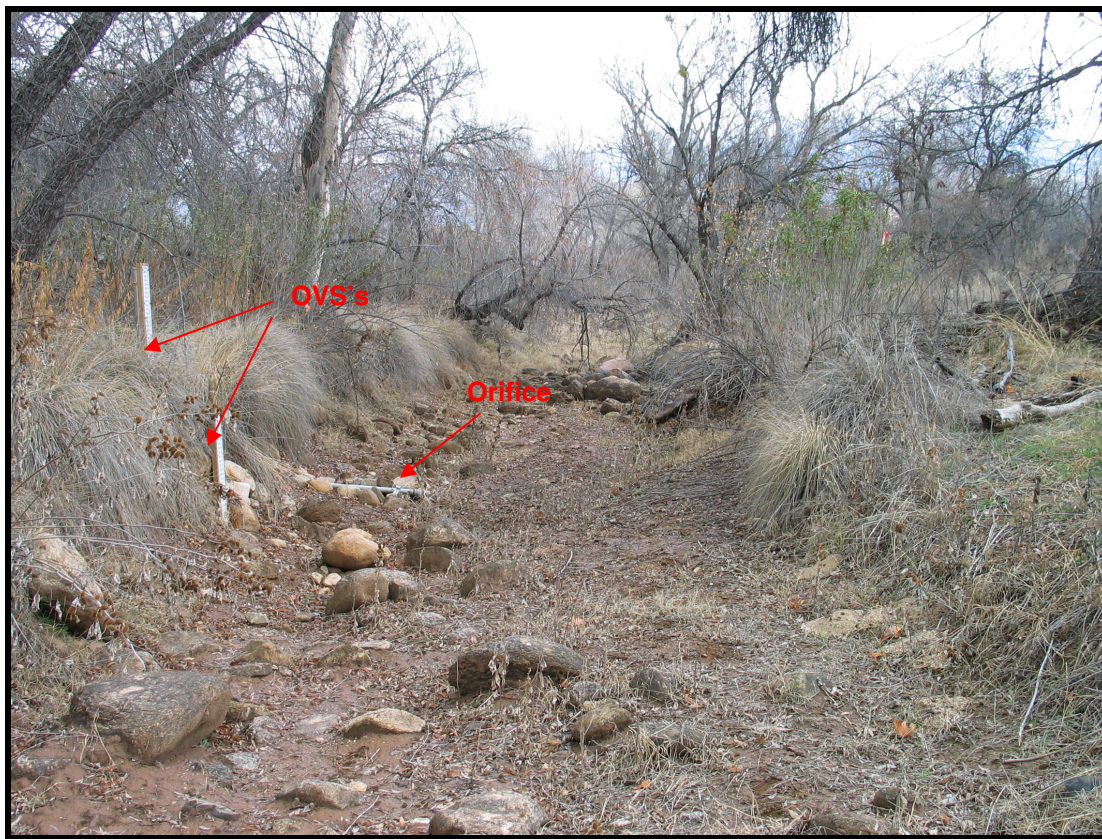


Figure 5: Photo looking upstream in February 2004 (photo taken 2/04/04 by Colleen Filippone)



Figure 6: Photo looking upstream in August of 2004 (photo taken 8/21/04 by Gwen Gerber)



Figure 7: Photo of data Collection Platform (photo taken 6/11/03 by Scott Grover)



Figure 8: Photo of orifice (photo taken 8/21/04 by Gwen Gerber)



Figure 9: Photo of lower and Upper Staff Plates (photo taken 8/21/04 by Gwen Gerber)



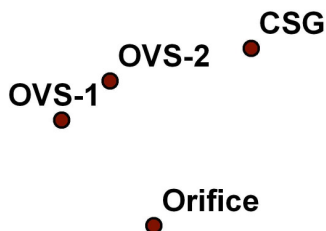
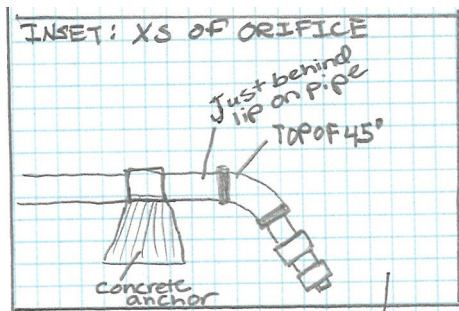
Rincon Creek Pool A Survey Locations

Ground Rod Base

SURVEY LOCATION DESCRIPTIONS		
Survey Point	Date Established	Description
Ground rod (base)	06/11/03	base: top of the data collection platform's ground rod
RM-1	06/25/04	reference mark 1: top of re-bar with end cap marked RM-1
RM-2	06/25/04	reference mark 2: top of re-bar with end cap marked RM-2
RM-3	06/25/04	reference mark 3: top of re-bar with end cap marked RM-3
OVS 1	06/11/03	bolt on low flow vertical staff plate at 3.084 ft (94 cm)
OVS 2	06/11/03	bolt on high flow vertical staff plate at 5.505 ft (167.8 cm)
Orifice	06/11/03	top of 45° - see sketch
Orifice	06/11/03	top of pipe just behind lip - see sketch
PZF	N/A	point of zero flow on control directly downstream of pool
CSG	05/24/05	head of bolt on crest stage gage at 4.947 ft

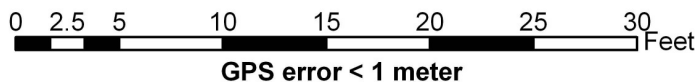
RM-2

RM-3



Legend

- Locations of Survey Points
- Approximate Location of Rincon Creek Thalweg



Data Collected by: Matt Daniels, Saguaro National Park using GPS June 29, 2005
Map Produced by: NPS Water Resources Division June 29, 2005

Figure 10: Survey Locations Sketch Map and Descriptions